



ANALYSIS OF APPLIED MEDICAL REHABILITATION IN CASES OF OBSTETRIC BRACHIAL PLEXUS LESION – ERB-DUCHENNE PALSY

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ABSTRACT

The aim of this study is to present the methods of medical rehabilitation and the results from methodical administration in cases of Duchenne-Erb palsy, with damaged C5 and C6 roots. From 2011 to 2016 we have administered complex medical rehabilitation (electrotherapy, kinesitherapy – passive, active, reflexive; medicinal massage – general, selective; alternative methods – acupressure, hyperbaric oxygen therapy) to 17 children aged from 2 months to 9 years old with obstetric brachial plexus lesions of different degrees of damage. The methods were tested and verified in clinical, out-patient

centers and at home and yielded very good results in 76% of the cases. After the end of the therapy, a statistically significant improvement was observed with regard to most of the surveyed parameters and indicators. The results in the working group marked a significant improvement as compared to the initial values as a result of the administered complex therapy, combined with Montessori-therapy, moxotherapy, game-therapy.

KEYWORDS: Medical rehabilitation, Erb-Duchenne palsy.

INTRODUCTION

The brachial plexus (plexus brachialis) is a network of nerves formed by the lower cervical nerves (C4, C5-C8) and thoracic nerves (Th1, Th2). Together with the subclavicular artery,

the brachial plexus is located in the lower part of the neck, behind the clavicle, which divides into two parts – supraclavicular and subclavicular brachial plexus.^[1,2] Among the diseases and conditions of the nervous system, brachial plexus injuries are not the most common, but they are characterized by a very slow recovery rate, their treatment is not always successful, and is connected with prolonged and expensive therapy, yet, despite the efforts and care, there are often residual lesions which differ in their degree of significance.

In cases of total damage to the upper primary root, the so called upper type of brachial damage results, or the Erb-Duchenne syndrome. In damage to the primary lower root, the result is a distal type of palsy – Dejerine-Klumpke palsy.^[1,3] The upper type of palsy is the most common. In the attempt to obtain the Moro reflex, the affected arm does not participate. Mild cases of this kind of palsy may pass unobserved and unidentified, or other conditions may be mistaken for brachial plexus palsy.^[4]

Every year, approximately 200-300 children are born with obstetric brachial plexus lesion in Bulgaria, that is once in approximately 1000 childbirths. The incidence is 0.1%-0.4% of all live born babies. There is a loss of sensitivity and weakness of the muscles innervated by the nerves stemming from the respective roots. Cases of damage to the upper cervical roots are more common. The most common risk factors are a weight of over 4000 g, shoulder dystocia, breech delivery, diabetes of the mother, and instrumental dilation. In the cases of upper palsy of the Duchenne-Erb type with a damage to the C5 and C6 roots, the arm hang in adduction and inner rotation, with an extension in the elbow, pronation of the forearm, and flexion of the wrist. The palmar grasp reflex is almost normal.^[5]

Obstetric traumatic injury of the brachial plexus (obstetric palsy) is observed in pathological childbirth, as a result of a big fetus, narrow reproductive pathways, breech delivery, shoulder dystocia, or childbirth arm or leg-first. The degree of damage to the brachial plexus nerves may vary – from a slight extension of the nerve and swelling, to the complete tearing of the nerve, tearing of the root from the spinal cord, or a trauma of the spinal cord and according to type, the damage can be: upper, upper and middle, lower or total. The most common cases are of those of upper (42.7%), upper and middle (26.04%) and total (28.65%) types of palsy.^[6,7,8]

As a result of overstretching of the brachial plexus, in most cases there is a mild palsy of the muscles. Motor, vegetative and sensory disorders, areflexia and vascular trophic disorders

occur. The clinical symptoms depend on the degree and localization of the damage. The most common in our practice is the proximal type. With it, there may be reduced sensitivity of the arm, lack of muscular control, partial or total palsy of the limb. The deltoid muscle, the flexors of the armpit are affected; the movements of the shoulder joint are limited or absent; there is no abduction, outer rotation and supination of the forearm. The knowledge and understanding of the dermatomes of the respective nerve roots and innervational skin areas facilitates diagnostics.^[9] Also positive is the syndrome of the peripheral motor neuron, characterized by: reduced strength, reduced reflexes or lack of such, muscular hypotonia to atonia, muscular atrophy, muscular fascicular twitching.^[10]

Medical rehabilitation administered in the early stage of the development of the new-born baby should be complex, polyvalent, gradual and competent, consistent with the rehabilitation potential, with the respective medical and non-medical procedures.

The development and implementation of the methods of complex medical rehabilitation for children with obstetric trauma are based on several principles:

- 1) Prompt /early/ start of the rehabilitation procedures;
- 2) Constant and continuous treatment for 7 or 8 years, followed by follow-up social and pedagogical rehabilitation and ergotherapy;
- 3) Comprehensiveness of the rehabilitation programme (position treatment, medicamentous treatment, physical therapy, massage, kinesitherapy, play-therapy and ergotherapy).^[6,7] The methods of medicinal exercise and gymnastics is characterized by predominant inclusion of active exercise. But each case is discussed and approached individually according to the functional abilities, established through manual muscle testing. Depending on the function of each damaged muscle, analytical exercises are administered.

The complex medical rehabilitation includes:

- 1) Preformed factors: in the acute stage: thermal procedures – infrared, solux in the area of the brachial plexus – 5 to 20 min.;
- 2) Electrophoresis – for improvement of mediation 0.02-0.06 A/cm², after the third year 0.1-0.2 A/cm², 10-30 min.;
- 3) Electrostimulation for 5-10 days, at low frequencies 0.25-0.5 Hz, duration of the impulse 50-100 ms^[11];

- 4) Electrotherapy: electrophoresis with Nivalin, along the length of the limb, with standard doses; electrostimulation of the respective muscle group, in the point method for each muscle; after Nivalin electrophoresis;
- 5) Light therapy – suberythemal UVR – the limb as a whole;
- 6) Thermal therapy and peloidotherapy (with paraffin, ozokerite, medicinal mud or sea lye) on the respective muscles, standard dosage.^[12]

The paraffin applications cover the shoulder the brachial and scapular areas.^[13] Physical therapy is prescribed by a doctor, specialist in physical and rehabilitation medicine. Medicinal massage is administered prior to kinesitherapy. The massage facilitates the reinnervation and boosts the motor function of the arm. In manual massage, we have combined classical, segmentary, periosteal massage and acupressure.

Acupressure is an efficient method in the complex therapy of peripheral mild palsies. The methods of slicing, and pressure in certain points are recommended. Painful points in the neck: GM 12, 20, 3E 16. PM 10; in the chest BD1; the back part of the arm: T 3, 7, 8, D 4, 10, 11; along the front side BD 3, 5, 7; P 3, 4, 6; C3, 7.^[14]

From the very beginning, the aim was to gradually reciprocally include arm-leg, needed for walking (locomotion), which is absent in children in the period of learning to walk. The undamaged muscles were set in motion – muscles whose capacity is not used by the child unless the child is trained to do so.

Proprioceptive stimulation using the methods of kinesitherapy plays a major role in overcoming the palsy of the arm. The following algorithm was used:

- 1) Reflexive exercises^[6];
- 2) Exercises for counter-lateral training;
- 3) Summation in Kanis method: Successive alteration of 3, 4 pushes in the direction of movement, which the paretic muscle would make, with a subsequent pause, followed by another 3, 4 pushes;
- 4) Transitional unconditional reflexes related to the ontogenetic development of the locomotor activity. Initially we used: the “mouth-hand” reflex; the Moro reflex; the Magnus reflex; the crawling reflex; the hand support reflex; the Landau reflex; the Vojta reflex; the Collins reflex.^[7,10] These were administered 5 to 10 times, rhythmically, so that the paretic

muscles could be stimulated, either as agonists or synergists in the main movement, with a 20-30 s pause between them;

- 5) Active movements – strictly analytically in the form of a game;
- 6) Exercises aimed at developing balance;
- 7) Exercises stimulating cognitive activity;
- 8) Exercises aimed at improving trophic-vegetative functions.

Proprioceptive neuromuscular facilitation techniques (PNMFT) – Kabbat's diagonals as techniques: facilitating one movement through another movement; summation of stimulation, stretching reflex, bilateral reflex, exercising antagonists) aimed at activating a great number of locomotor groups.^[15]

- 9) Reflex locomotion (Reflex Locomotion/Vojta): stimulating reflexive turning and reflexive crawling through key positions, trigger zones, directed pressure in the trigger zones; stimulating the trigger zone from 1-3 to 5 minutes.

The combination between the trigger zones and the positions is determined by the clinical symptoms, the degree of damage to the arm and its motor skills and the age of the child.^[16]

- 10) Position therapy, protecting m. deltoideus and m. supraspinatus from overstretching. Position therapy is administered during sleep by means of longettas.^[13]

Kinesitherapy is difficult as it is administered to young children who are unable to perform voluntary exercise. Reflexive stimulation of voluntary contractions – stimulating certain areas of the skin – are also applied. As the child grows and active movements are achieved in the paralytic areas, the aim is for the child to master correctly certain motor habits and to avoid discoordination in movements, especially in the shoulder joint, as well as to use the affected limb more and more.

The aim of this study is to present the methods of medical rehabilitation and the results from its two-year, methodical administration in cases of Duchenne-Erb palsy, with damaged C5 and C6 roots.

MATERIALS

In the course of four successive years, from 2011 to 2016, we have administered complex medical rehabilitation therapy to 17 children aged from 2 months to 9 years old, with

obstetric brachial plexus lesions of different degrees of damage: 7 (41.2% ± 18.60) (upper palsy), 6 (35.3% ± 19.51) (upper; middle palsy), 4 (23.5%) (total palsy).

METHODS

We monitored the changes in the tests and examinations through electromyography, Active Movement Scale – for new-born babies and infants up to 3 years of age, kinesiological diagnostics of Malet for the function of an upper limb, manual muscle testing, testing of the unconditional reflexes at the beginning, in the course of and at the end of this stage of neuro-rehabilitation, functional diagnostic Upper Limb Tension Test – ULTT 1-4), with stretching of the brachial plexus. During such tests, the nerves innervating the upper limb are exposed to stress.

Reflexes and sensitivity have been tested: the reflexes of *m. pectoralis major* –pars *clavicularis* (C5-C6); the reflexes of *m. bicepsbrachii* (C5-C6); the reflexes of *m. tricepsbrachii* (C7-C8).

RESULTS AND DISCUSSION

The object of presentation are patients with upper palsy of Duchenne-Erb, treated at: “St. George” University Hospital, Plovdiv; as out-patients and undergoing rehabilitation therapy at home by well-trained mothers. In all cases, medical rehabilitation therapy was started promptly and as early as possible, since they were diagnosed.

The patients have been divided into two groups – a working group (average age – 5.9 year) and a control group (average age – 6.2 years). The girls constitute 55.6% of the working groups, and the boys – 44.4%. In the control group, 37.5% are girls and 62.5% are boys. There is no statistically significant difference in the division by gender and age between the groups.

The children were grouped in the working and the control groups randomly. The children were distributed in various groups depending on the number of injured nerves, whether they had some muscle activity in their biceps or deltoid muscles.

According to the type of injury: in the working group, 4 children (44.4%) have upper palsy, 3 (33.4%) have upper and middle palsy and 2 (22.2%) have total palsy; in the control group, 3 children (37.5%) have upper palsy, 3 (37.5%) have upper and middle palsy and 2 (25%) have total palsy.

Rehabilitation therapy provides all-round, versatility and gradualness of the treatment of the obstetric lesion of the brachial plexus. This therapy is administered by a team of specialists who develop integrated short-term and long-term strategies, consistent with the calendar and motor age of the child, which, in turn, preconditions the efficiency of the administered methods of treatment.

This therapy ensures real conditions for reducing the rate of severe disabling of the concerned children, providing them with the opportunity to recover completely. It was established in the long years of applying these methods into practice that when patients do maximum exercise for several hours every day, the motor functions of the affected limb are restored much more quickly. Each component of the described methods have been known and put into practice for a long time, but the key to this success is in the use of the locomotor apparatus, its dynamics and the complexity of movements.^[17]

The inclusion of analytical exercises and training of the muscles increases the recovery effect, as evidenced by the centimetry data and MMT data of our patients.^[18] The damaged parts and muscles are: n. axillaris, n. musculocutaneus, m. deltoideus, m. coracobrachialis, m. supraspinatus, m. infraspinatus, m. subscapularis, m. teresminor, m. bicepsbrachii, m. brachioradialis, m. brachialis.

The results from the many years of practice with children with obstetric brachial plexus lesions show that in order to attain good results from the medicinal rehabilitation therapy, accurate diagnostics is of vital importance, including accurately performed MMT with results that are comparable with those from EMG (electromyography) and adequately conducted physiotherapeutic and rehabilitation therapy.^[19,20]

The combination of physiotherapeutic procedures, massage, reflector exercises, proprioceptive facilitating techniques with analytical exercises, conducted on a daily basis, contributes to the more complete recovery. The traditional treatment approach for motor deficits after OBPP is mainly based on techniques aiming at stimulating the use of the affected limb during supervised training sessions.^[21,22]

The applied methods were tested and verified in clinical, out-patient centers, as well as in the homes of the patients. The methods yielded very good results in 76% of the cases. In both groups, after the end of the therapy, a statistically significant improvement was observed with

regard to most of the surveyed parameters and indicators. The tendency to keep up the attained results, however, differs considerably.

The results in the working group marked a significant improvement as compared to the initial values as a result of the administered complex therapy, combined with Montessori-therapy, moxotherapy and game-therapy. The shoulder range of movement in C5–C6 palsies was significantly better in the working group. A positive change in all the muscles innervated by the damaged brachial plexuses is observed.

The changes in some of the muscles of the affected limb are provided in Table 1:

Table 1. Data from the manual muscle testing.

Muscle	Initial testing X ₁	Final testing X ₂ Control group	d=X ₂ -X ₁	Final testing X ₂ Working group
m. deltoideus	0	4	4	4+
m. bicepsbrachii	0	4	4	4+
m. brachialis	0	4	4	4+
m. brachioradialis	0	4	4	4+
m. tricepsbrachii	0	4	4	4+
m. supinator	2	4	2	4+
m. pronatorteres	2	4	2	4+
m. flexorcarpiulnaris	2	5-	3	5
m. extensorcarpiulnaris	2	5-	3	5
m. flexordigitorumprofundos	2	5-	3	5
m. flexordigitorum superficialis	2	5-	3	5
m. interosseipalmaris	2	5-	3	5
m. interosseidorsalis	2	5-	3	5
m. lumbricales	2	5-	3	5

CONCLUSIONS

The results achieved in our work with children with obstetric brachial plexus lesions, which we continue doing as part of our daily work, provide sufficient grounds for us to recommend the approbated complex methods of rehabilitation in cases of Duchenne-Erb paralysis. But there has been a delay in the recovery of the patients with the fine motion of the activities for selfservice of the paretic hand. It is necessary the patients and their relatives to be trained to apply continuously the rehabilitation activities along with the ergotherapeutical at home. The most important aspect of therapy is timely recognition and referral, to prevent the various possible sequelae affecting the shoulder, elbow, or forearm.

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